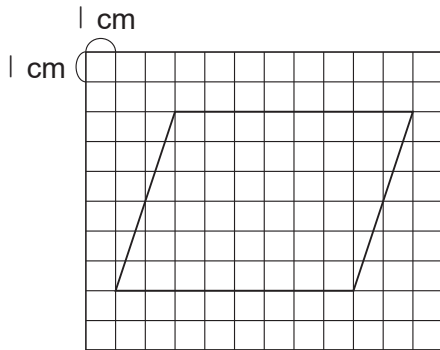


14-1

Area of Quadrilaterals and Triangles

Area of Parallelograms (1)

Instruction Find the area of the parallelogram below.



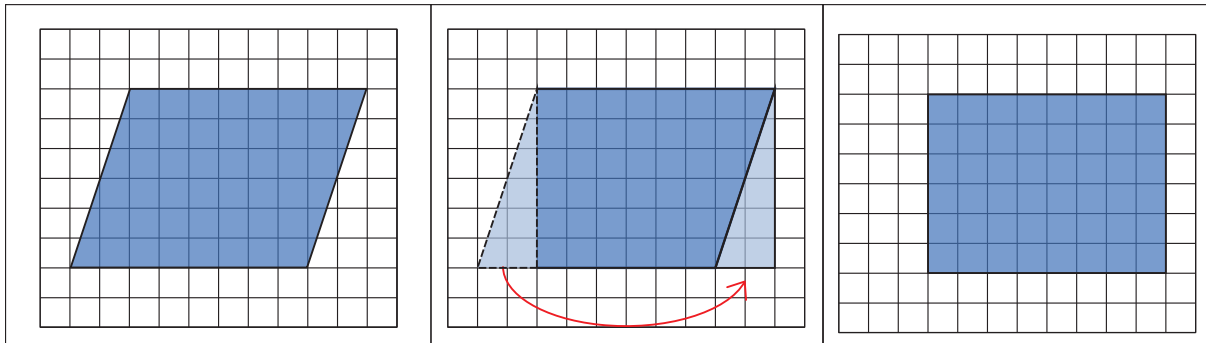
We learned how to find the area of a rectangle in the previous grade.



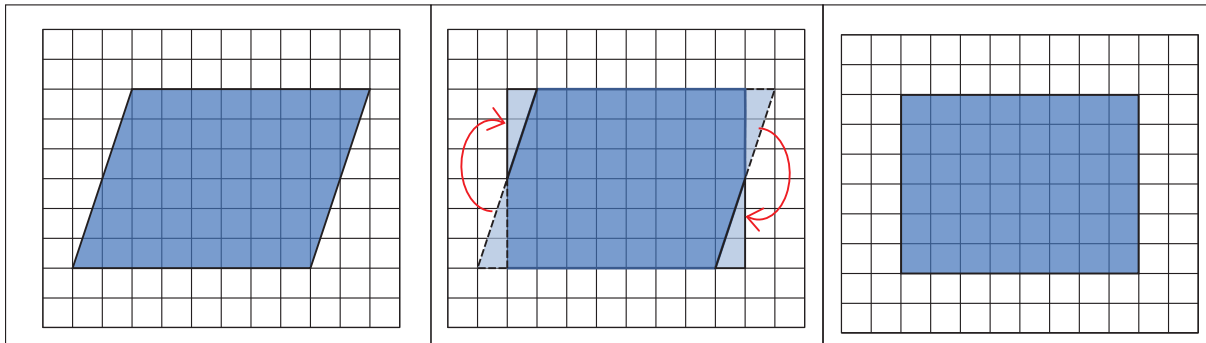
The area of a parallelogram can be found by changing the figure into a rectangle.



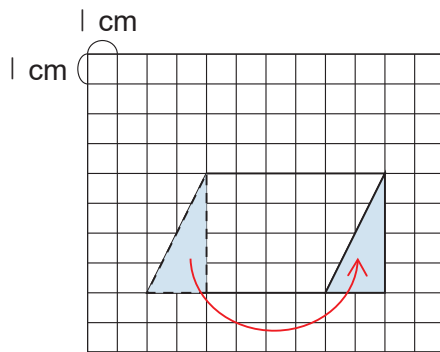
We can change the figure into a rectangle as follows:



We can also change it as follows.



Example Find the area of the parallelogram below.



1 What is the length and width of the rectangle we can make from this parallelogram?

Length **6 cm**

Width **4 cm**

We cut and move a part of parallelogram to make rectangle. Length is longer than width.

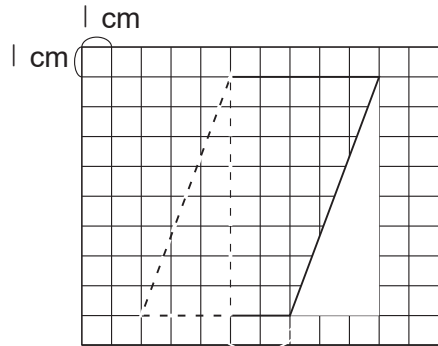


2 How many cm^2 is the area?

Math
sentence $6 \times 4 = 24$

Answer 24 cm^2 

1 Find the area of the parallelogram below.



1 How many cm in lengths and widths is the rectangle is equal to the area of this parallelogram?

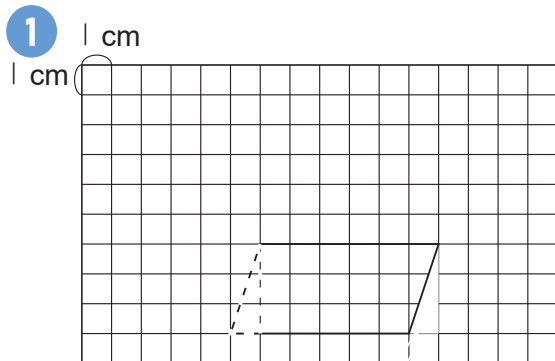
Length Width

2 How many cm^2 is the area?

Math
sentence

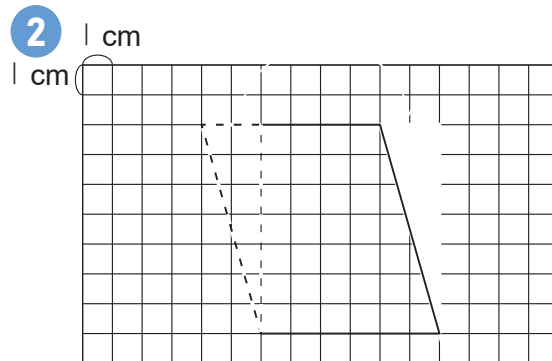
Answer _____

2 Find the area of the following parallelograms by cutting and moving a part of parallelogram to make rectangle.



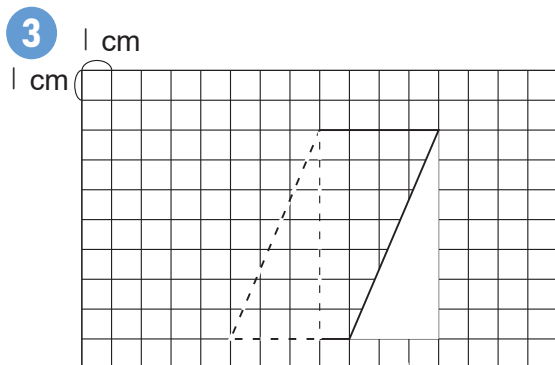
Math
sentence

Answer _____



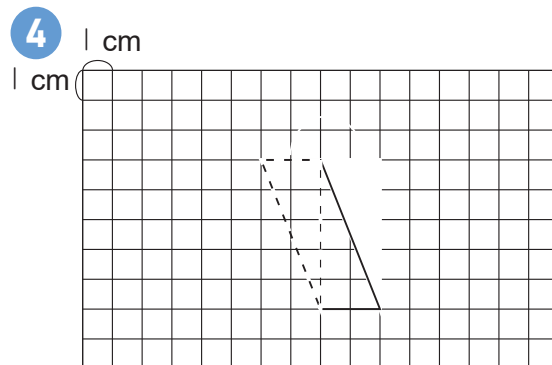
Math
sentence

Answer _____



Math
sentence

Answer _____



Math
sentence

Answer _____

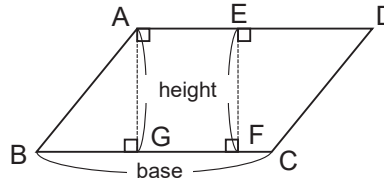
14-2

Area of Quadrilaterals and Triangles

Area of Parallelograms (2)

Instruction Area of Parallelogram

- Base is a side of polygon, particularly one oriented perpendicular to the direction in which height is measured.
- Draw straight line AG, EF, and other lines which are perpendicular to the base of BC. The length of these straight lines is called the height against the base of BC.



Even if you don't change the figure into a rectangle, you can find the area by calling "length" is base and "width" is height.

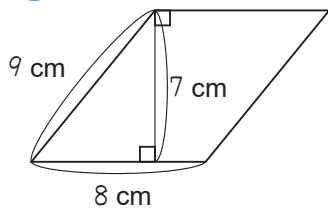


$$(\text{Area of Parallelogram}) = (\text{Base}) \times (\text{Height})$$

Example Regarding the parallelogram below, answer the following questions.

1 How long does the base and height? Base Height

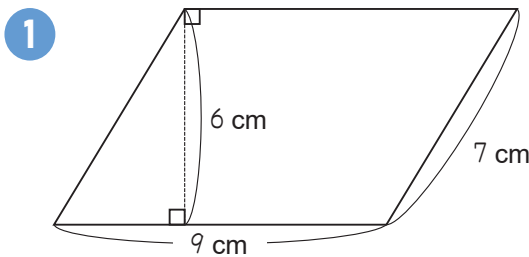
2 Find the area of the following parallelogram.



Math sentence $8 \times 7 = 56$

Answer

1 Find the length of the base and height, and the area of the following parallelograms.

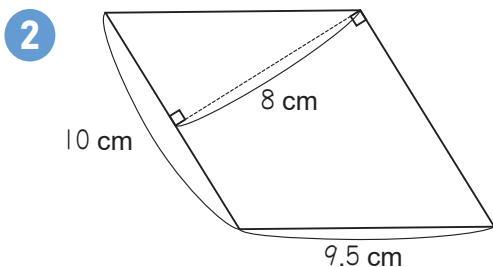


Base Height

Math sentence

Answer _____

Height is perpendicular to the base.



Base Height

Math sentence

Answer _____

Base does not come to the bottom of the figure all the time.

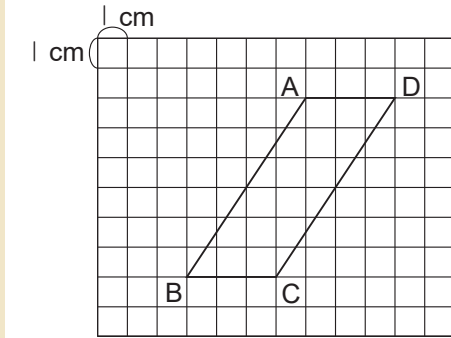


14-3

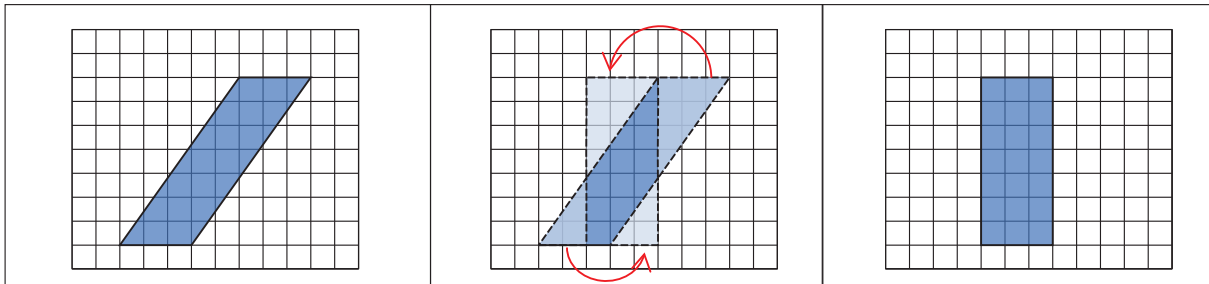
Area of Quadrilaterals and Triangles

Area of Parallelograms (3)

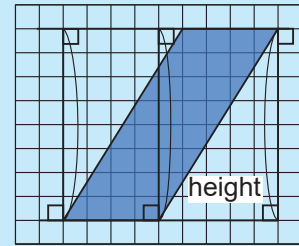
Example Find the area of the parallelogram shown below when BC is the base.



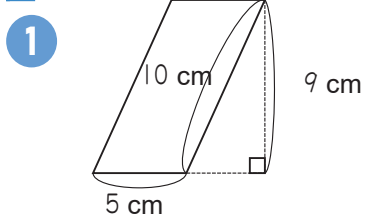
To find the height, change the figure into a rectangle.



- When the side BC is the base, the distance between the two lines is the height of parallelogram ABCD.

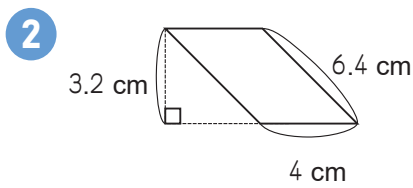


1 Find the area of the following parallelograms.



Math
sentence

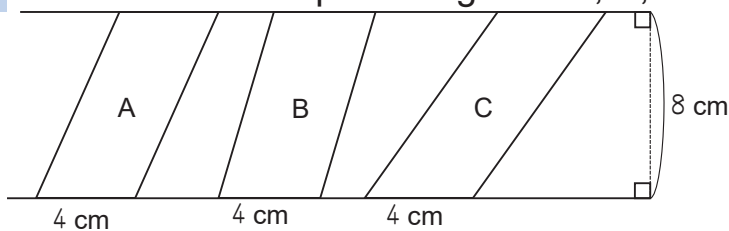
Answer _____



Math
sentence

Answer _____

2 Find the area of parallelograms A, B, and C.



Parallelogram A

Parallelogram B

Parallelogram C

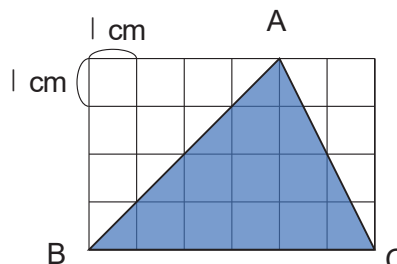
14-4

Area of Quadrilaterals and Triangles

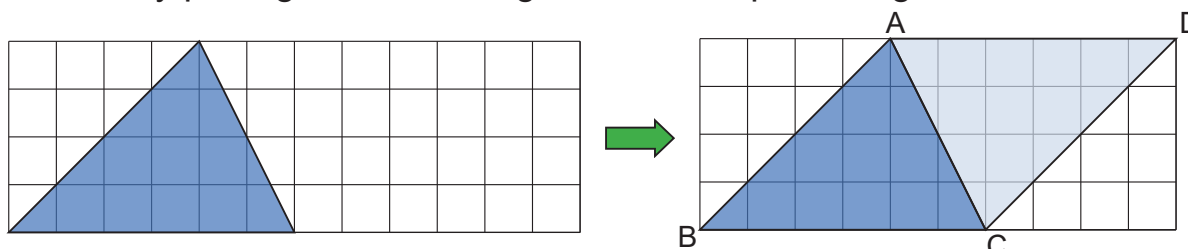
Area of Triangles (1)

Instruction How to find the area of the triangle on the right.

I wonder we can find the area by measures we already know.



Idea 1: By putting another triangle to make a parallelogram



If you put the same triangle ABC, you can make parallelogram ABCD. You already know how to find the area of a parallelogram. So...



Then, you can find the area and halve it.

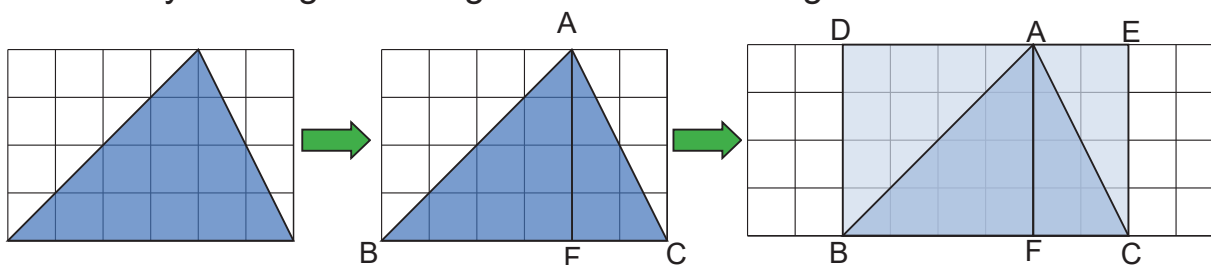
Math sentence

$$6 \times 4 \div 2$$

Base of parallelogram ABCD

Height of parallelogram ABCD

Idea 2: By dividing the triangle to make a rectangle



If you divide the triangle into two ABF and AFC, then you put the same size of these triangles, you can make a rectangle, DBCE. You already know how to find the area of a rectangle. So...



Then, you can find the area of the rectangle and halve it.

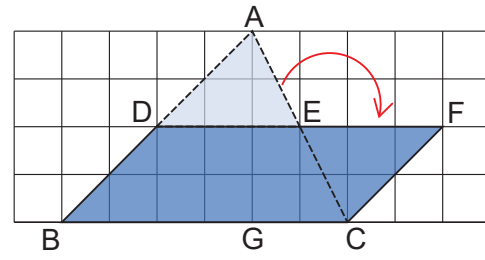
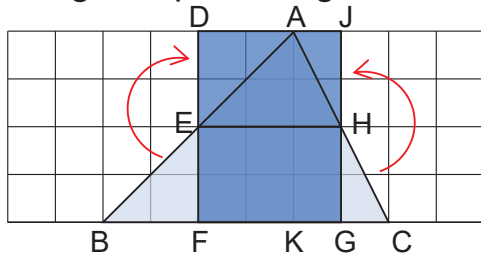
Math sentence

$$6 \times 4 \div 2$$

Length of rectangle DBCE

Width of rectangle DBCE

Alternatively, you can cut some part of the triangle and move to make rectangle or parallelogram.

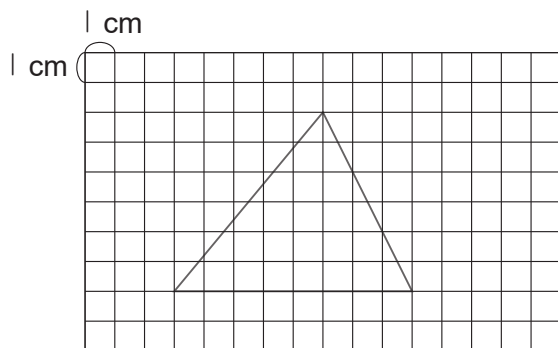


What are the similarities and differences among the ideas on how to find the area of the triangle?

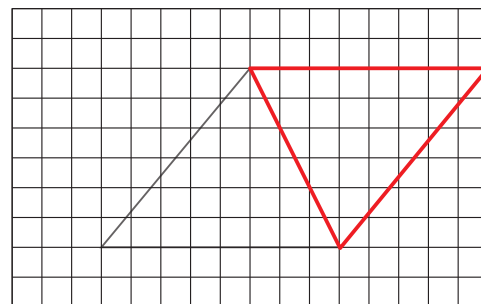
If you can change a triangle into a rectangle or parallelogram, you can find the area.



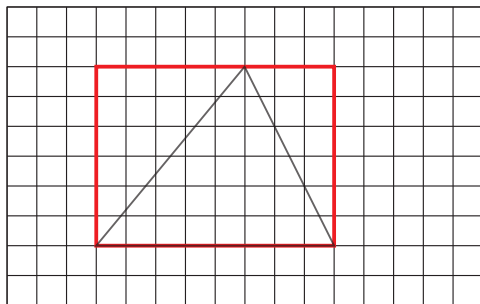
Example Find the area of the following triangle.



By using Idea 1



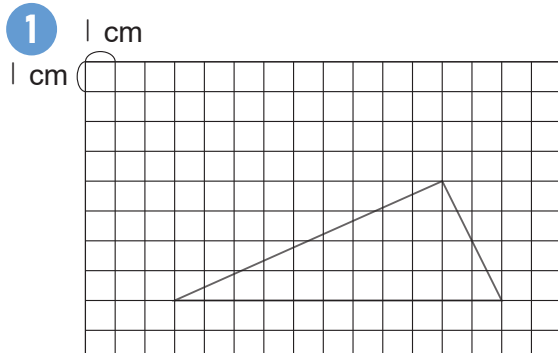
By using Idea 2



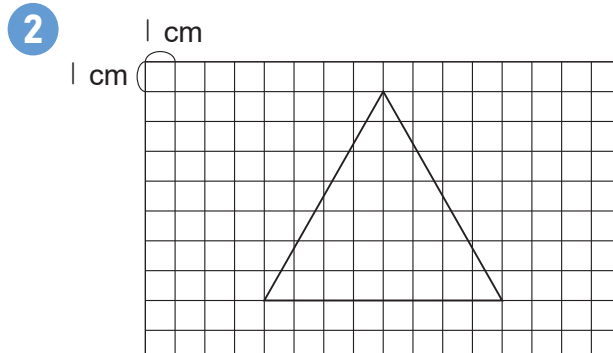
Math sentence $8 \times 6 \div 2 = 24$

Answer 24 cm^2

Find the area of the following triangles.



Math sentence
Answer _____



Math sentence
Answer _____

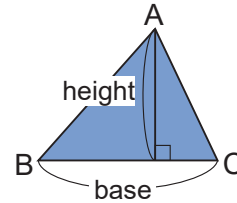
14-5

Area of Quadrilaterals and Triangles

Area of Triangles (2)

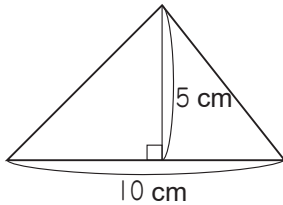
Instruction Area of Triangle

- When side BC is the base of the triangle, the height is the length of the perpendicular line that extends from vertex A to base BC.



$$(\text{Area of Triangle}) = (\text{Base}) \times (\text{Height}) \div 2$$

Example Find the area of the following triangle.

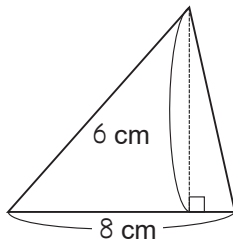


Math sentence $10 \times 5 \div 2 = 25$

Answer 25 cm²

Find the area of the following triangles.

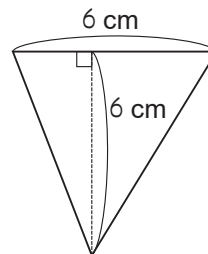
1



Math sentence

Answer _____

2



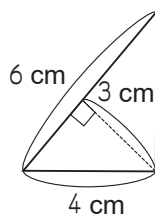
The base is not always at the bottom.



Math sentence

Answer _____

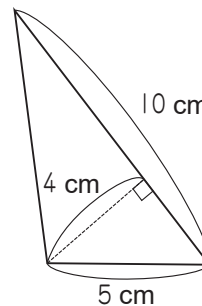
3



Math sentence

Answer _____

4



Math sentence

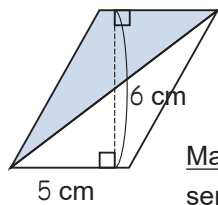
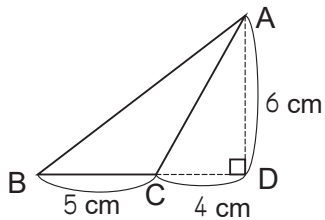
Answer _____

14-6

Area of Quadrilaterals and Triangles

Area of Triangles (3)

Example Find the area of the triangle shown below when BC is the base.



Where is the height of a triangle?
By putting another triangle to make a parallelogram.

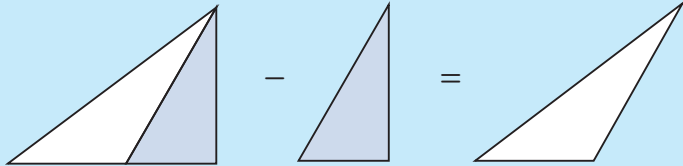


Math
sentence

$$5 \times 6 \div 2 = 15$$

Answer 15 cm²

How about subtracting triangle ACD from triangle ABD?



Math
sentence

$$(5 + 4) \times 6 \div 2 = 27$$

$$4 \times 6 \div 2 = 12$$

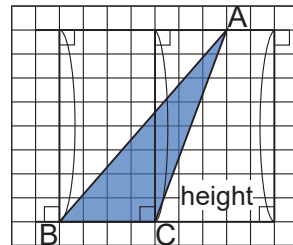
$$27 - 12 = 15$$

Answer 15 cm²

The both ideas can find the same area. So the height of triangle ABC is 6 cm.

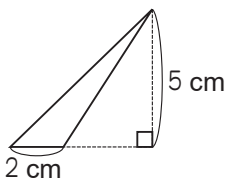


- When the side BC is the base, the distance between the two lines is the height of the triangle ABC.



1 Find the area of the following triangles.

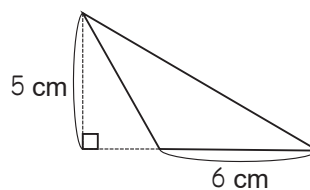
1



Math
sentence

Answer _____

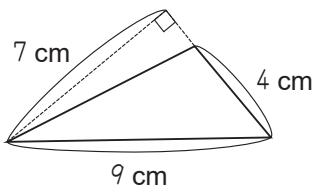
2



Math
sentence

Answer _____

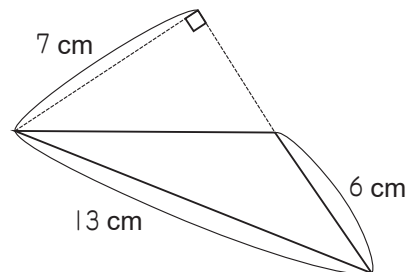
3



Math
sentence

Answer _____

4



Math
sentence

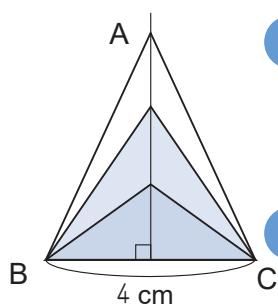
Answer _____

14-7

Area of Quadrilaterals and Triangles

Area of Triangles (4)

Example A triangle has the base of 4 cm. The height is increased from 1 cm to 2 cm. Answer the following questions.



1 Find the area of the triangle when the height is 1 cm.

Math sentence $4 \times 1 \div 2 = 2$

Answer 2 cm^2

2 How much does the area increase every time the height is increased by 1 cm? Complete the table below.

Height (cm)	1	2	3	4	5	6	7
Area (cm ²)	2	4	6	8	10	12	14

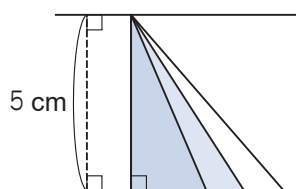
3 When the height changes from 2 cm to 4 cm, how many times does the area increase?

Times **Twice**

4 Write a math sentence to find the area of a triangle with a height of \triangle cm and an area of \bigcirc cm².

$$4 \times \triangle \div 2 = \bigcirc$$

A right angle triangle has the height of 5 cm. The base is increased from 1 cm to 2 cm and so on. Answer the following questions.



1 When the base is 1 cm, find the area of the triangle.

Math sentence

Answer _____

2 How much does the area increase every time the height is increased by 1 cm? Complete the table below.

Base (cm)	1	2	3	4	5	6	7
Area (cm ²)							

3 When the base changes from 4 cm to 12 cm, how many times does the area increase?

Times

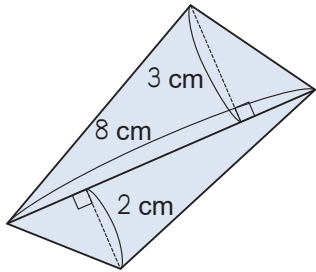
4 Write a math sentence to find the area of a triangle with a base of \square cm and an area of \bigcirc cm².

14-8

Area of Quadrilaterals and Triangles

How to Find the Area of Various Figures

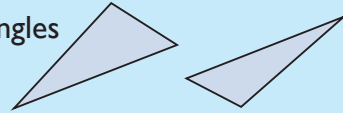
Example Find the area of the following figures.



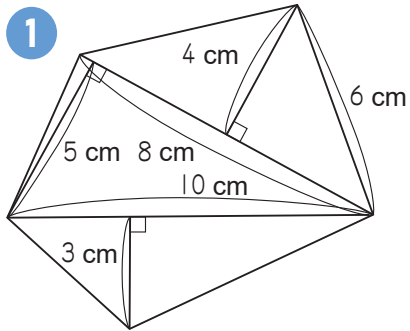
Math $8 \times 3 \div 2 = 12$ $12 + 8 = 20$
sentence $8 \times 2 \div 2 = 8$

Answer 20 cm^2

Dividing them into two triangles



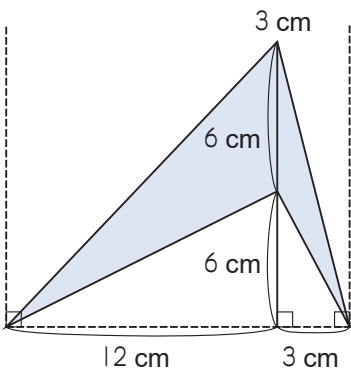
1 Find the area of the following figures.



Math
sentence

Answer _____

Example 2 Find the area of the following figures.

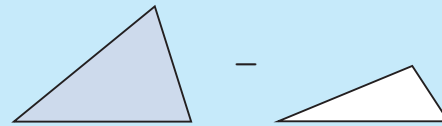


Math $(6 \times 12 \div 2) + (6 \times 3 \div 2) = 36 + 9 = 45$
sentence

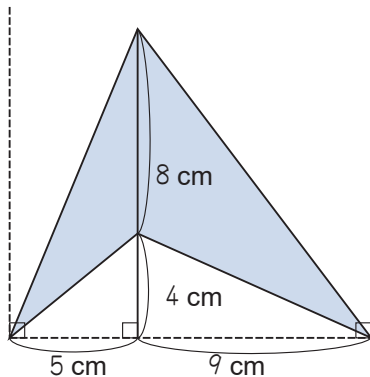
Alternatively,
 $(15 \times 12 \div 2) - (15 \times 6 \div 2) = 90 - 45 = 45$

Answer 45 cm^2

Alternatively, subtract two triangles



2 Find the area of the following figures.



Math
sentence

Answer _____



The area of a quadrilateral or a pentagon can be found by dividing them into triangles.

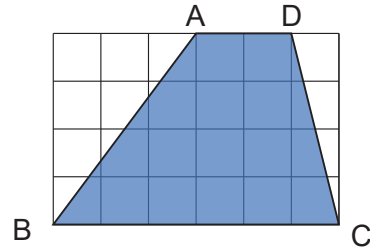
14-9

Area of Quadrilaterals and Triangles

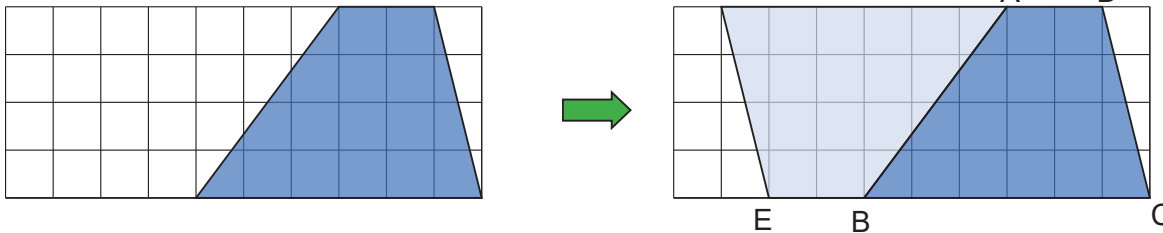
Area of Trapezoids (I)

Instruction How to find the area of the trapezoid on the right.

Let's think about it. I wonder we can find like rectangles and triangles.



Idea 1: By putting another trapezoid to make a parallelogram



If you put the same trapezoid ABCD, you can make parallelogram FECD. Now you can find the area of a trapezoid. So...



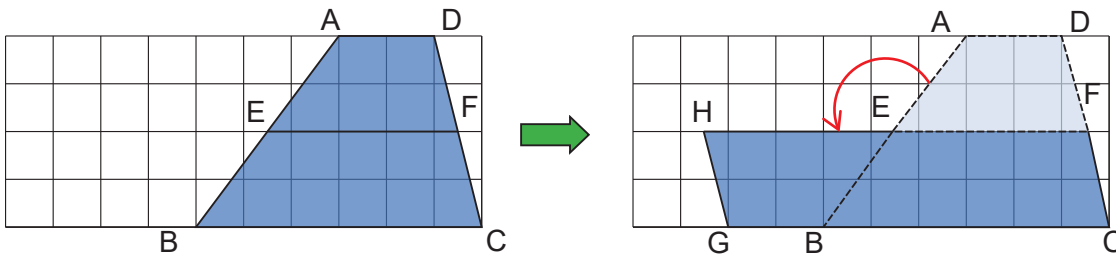
Then, you can find the area and halve it.

Math sentence $8 \times 4 \div 2$

Base of parallelogram FECD

Height of parallelogram FECD

Idea 2: By changing the trapezoid to make a parallelogram



If you divide the trapezoid into two AEFD and EBCF, then you turn and move AEFD, you can make a parallelogram, HGCF. You already know how to find the area of a parallelogram. So...



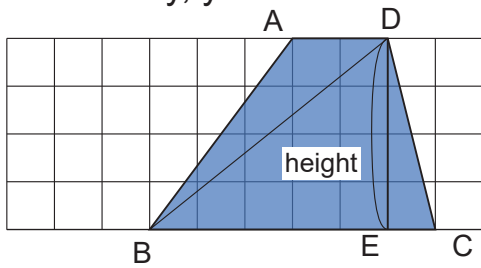
Then, you can find the area of the parallelogram.

Math sentence 8×2

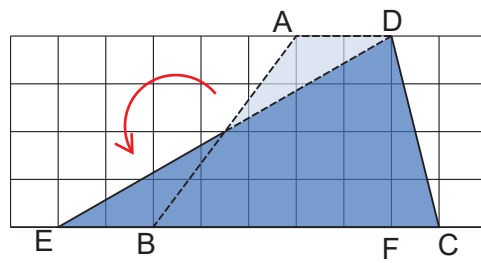
Base of parallelogram HGCF

Height of parallelogram HGCF

Alternatively, you can find the area as follows.



Since the area is sum of triangle ABD and triangle DBC, and then the height is DE,
 $(AD \times DE) \div 2 + (BC \times DE) \div 2$
 $(2 \times 4) \div 2 + (6 \times 4) \div 2$

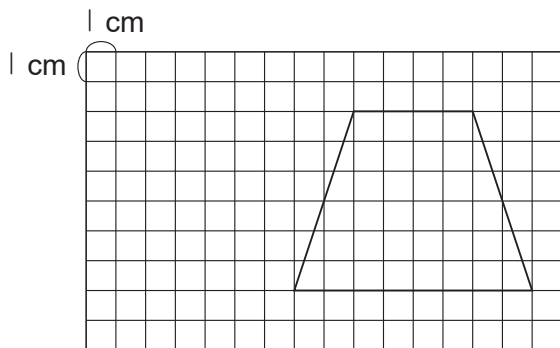


Since the base of the triangle is $AD + BC$ and the height is DF,
 $(AD + BC) \times DF \div 2$
 $(2 + 6) \times 4 \div 2$

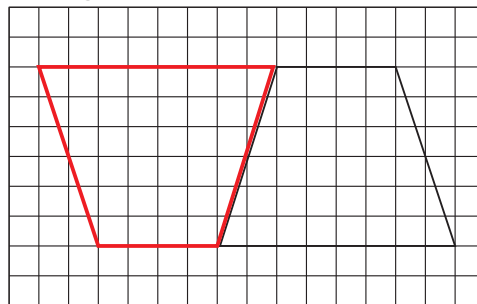
What are the similarities and differences among the ideas on how to find the area of the triangle?
 If you can change a triangle into a rectangle or parallelogram, you can find the area.



Example Find the area of the following triangle.

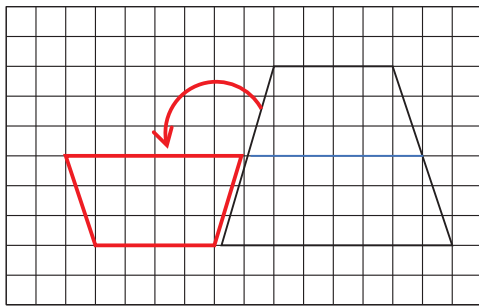


By using Idea 1



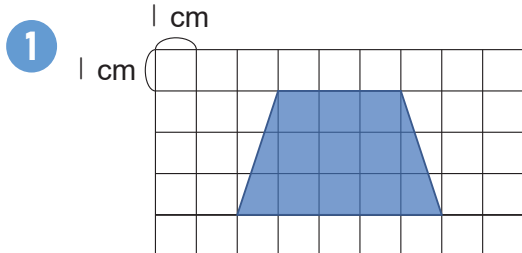
Math sentence $12 \times 6 \div 2 = 36$

By using Idea 2



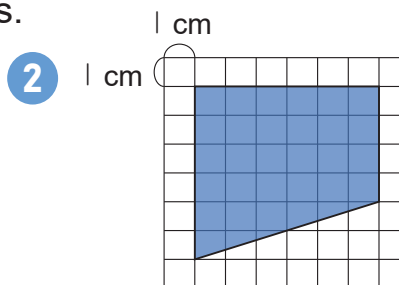
Answer 36 cm²

Find the area of the following trapezoids.



Math sentence

Answer _____



Math sentence

Answer _____

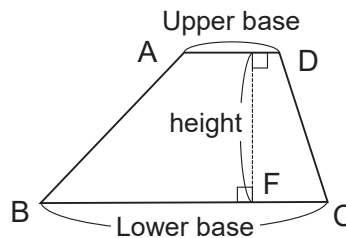
14-10

Area of Quadrilaterals and Triangles

Area of Trapezoids (2)

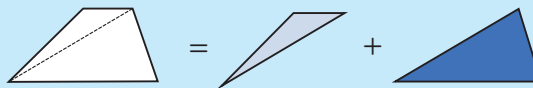
Instruction Area of Trapezoid

- The two parallel sides of the trapezoid are called upper base and lower base, and the distance between them is called the height.
- If you know the upper base, the lower base, and height, the area of a trapezoid can be found.

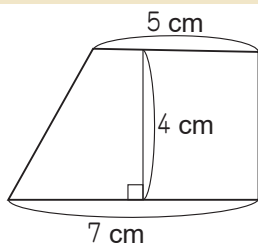


$$(\text{Area of Trapezoid}) = (\text{Upper base} + \text{Lower base}) \times (\text{Height}) \div 2$$

You can also find the area by dividing the trapezoid into triangles.



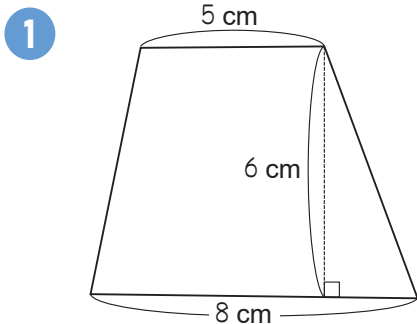
Example Find the area of the following trapezoid.



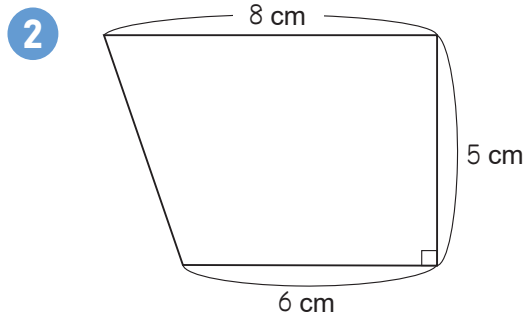
Math sentence $(5 + 7) \times 4 \div 2 = 24$

Answer 24 cm^2

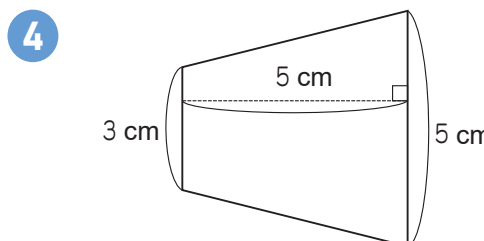
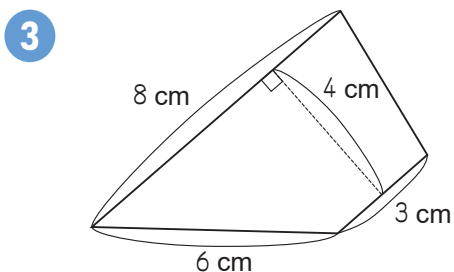
1 Find the area of the following trapezoids.



Math sentence
Answer _____



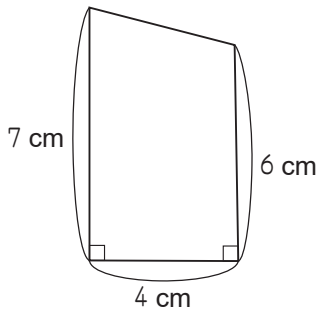
Math sentence
Answer _____



Math
sentence

Answer _____

5



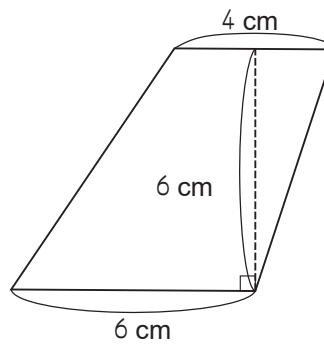
Math
sentence

Answer _____

Math
sentence

Answer _____

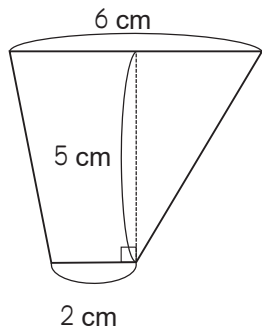
6



Math
sentence

Answer _____

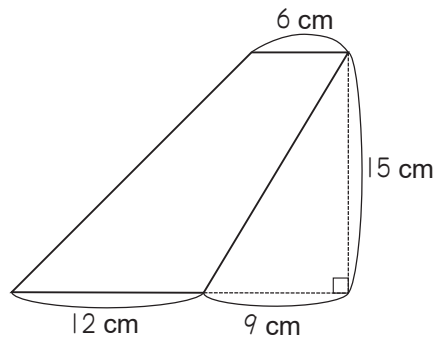
7



Math
sentence

Answer _____

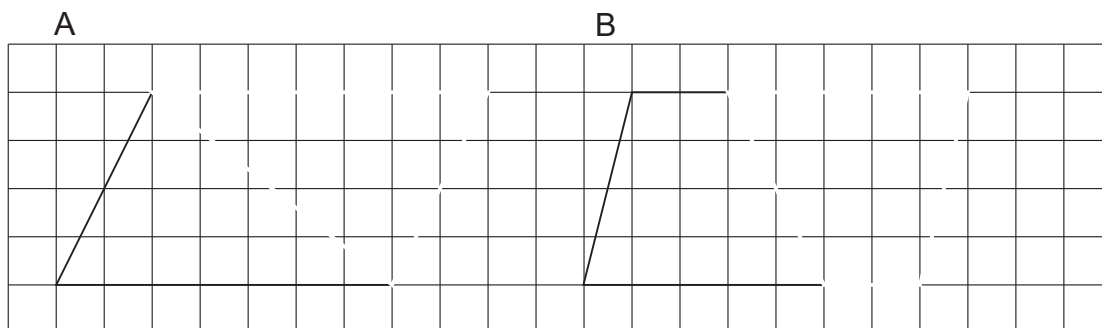
8



Math
sentence

Answer _____

2 Compare the areas of the following figures by adding another figure to calculate easily.



The area of figure A:

The area of figure B:

The area of the figure A is

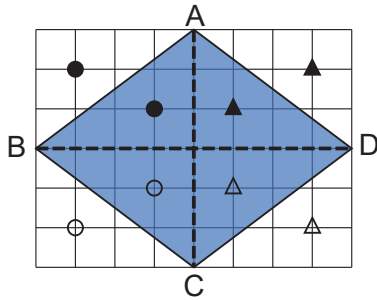
14-11

Area of Quadrilaterals and Triangles

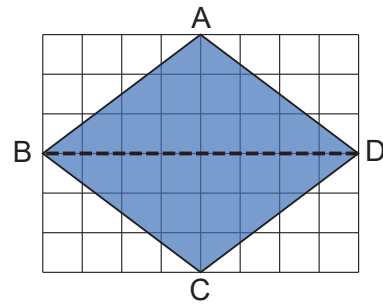
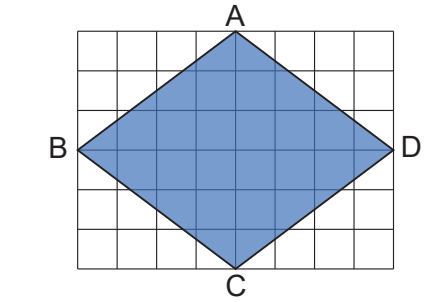
Area of Rhombuses (I)

Instruction How to find the area of the rhombus on the right.

Idea 1: Dividing the rhombus and find the area

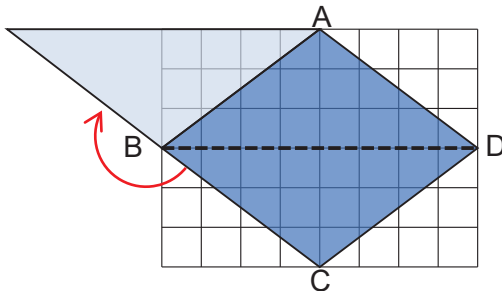


Half of the area of a rectangle

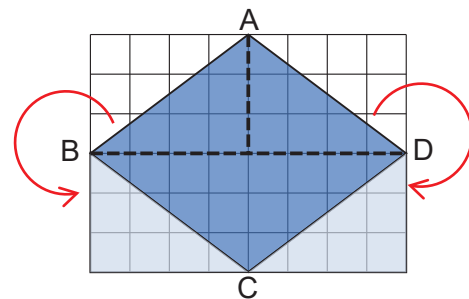


Dividing a rhombus into two triangles

Idea 2: Changing the rhombus into a known figure and find the area

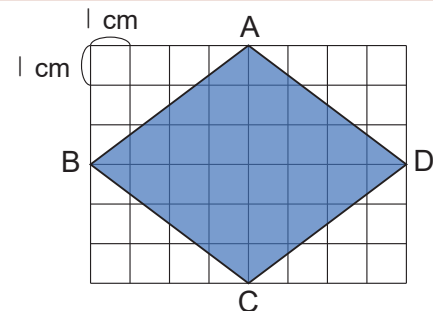


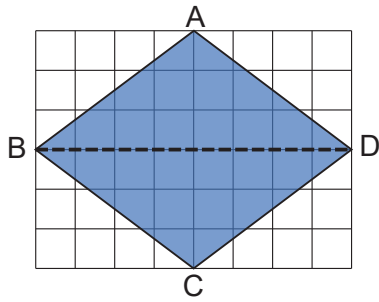
Changing it into a parallelogram
base \times height



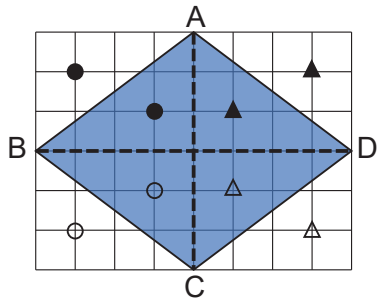
Changing it into a rectangle
length \times width

1 Find the area of the rhombus on the right.
Match the diagrams and explanations.

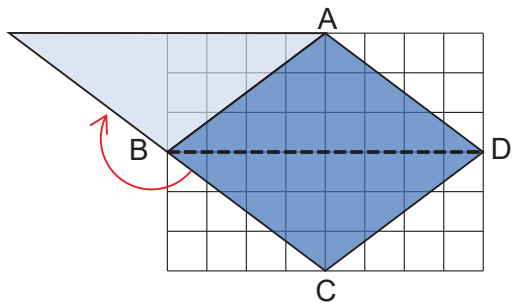




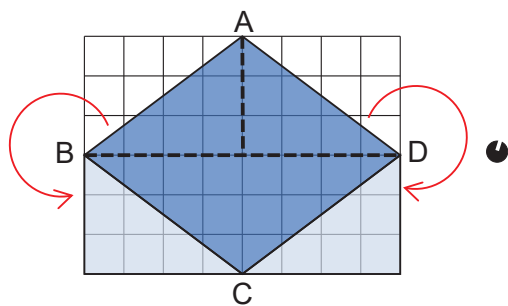
Diving a rhombus into two triangles,
 $(8 \times 3 \div 2) \times 2$



Changing it into a rectangle
 length \times width,
 $8 \times (6 \div 2)$

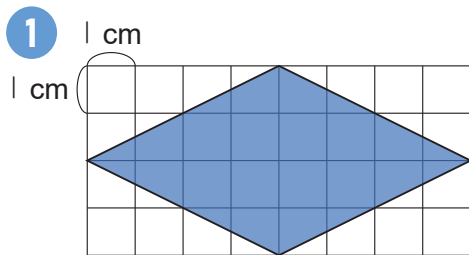


Changing it into a parallelogram
 base \times height,
 $8 \times (6 \div 2)$



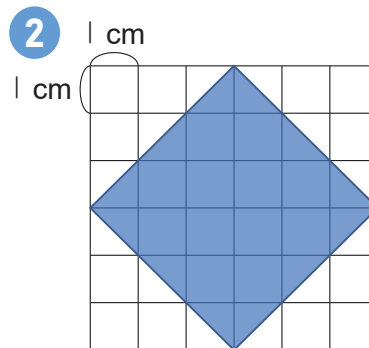
Since it is half of the area of a rectangle,
 $(8 \times 6) \div 2$

2 Find the area of the following rhombuses.



Math
sentence

Answer _____



Math
sentence

Answer _____

Can we find the area of a rhombus by using a formula?



14-12

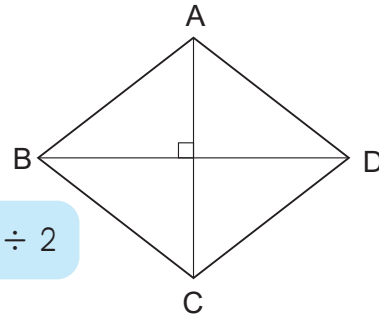
Area of Quadrilaterals and Triangles

Area of Rhombuses (2)

Instruction Area of Rhombus

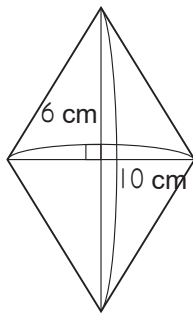
- If you know the length of the two diagonals, the area of rhombus can be found.

$$(\text{Area of Rhombus}) = (\text{Diagonal}) \times (\text{Diagonal}) \div 2$$



Example 1 Find the area of the following rhombus.

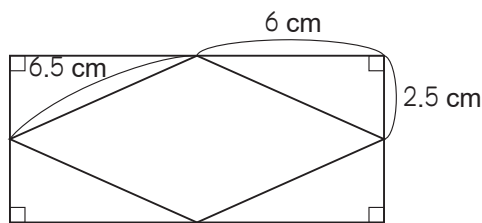
1



Math sentence $6 \times 10 \div 2 = 30$

Answer 30 cm²

2

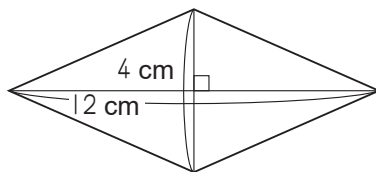


Math sentence $(2.5 \times 2) \times (6 \times 2) \div 2 = 30$

Answer 30 cm²

Find the area of the following rhombuses.

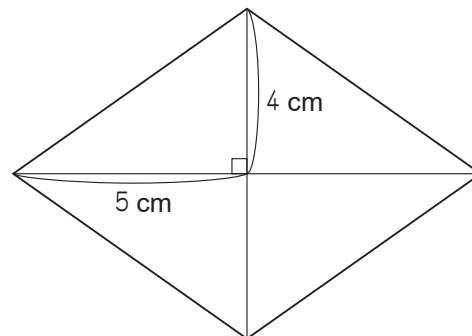
1



Math sentence

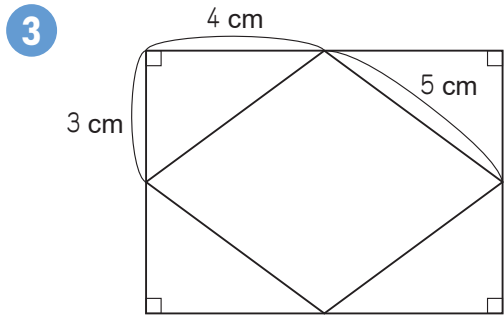
Answer _____

2



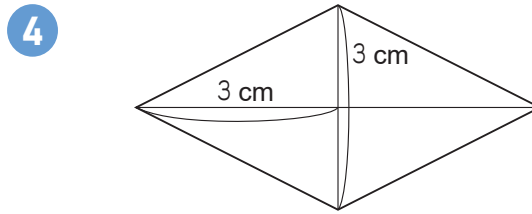
Math sentence

Answer _____



Math
sentence

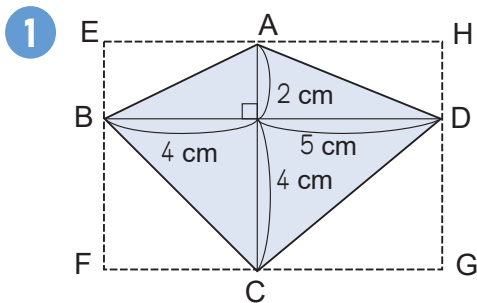
Answer _____



Math
sentence

Answer _____

Example 2 Find the area of the following figure.



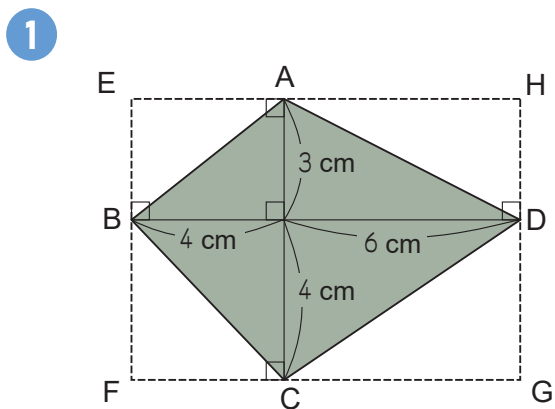
Math
sentence $6 \times 9 \div 2 = 27$

Answer 27 cm²

The area of the figure equals to the half area of the rectangle EFGH.

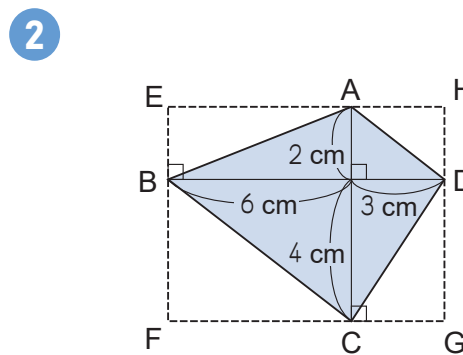


2 Find the area of the following figures.



Math
sentence

Answer _____



Math
sentence

Answer _____

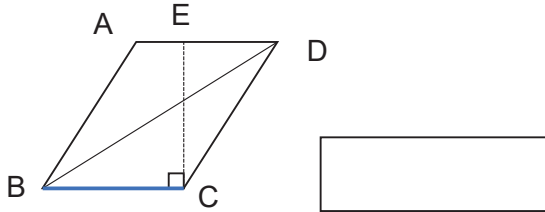
14-13

Area of Quadrilaterals and Triangles

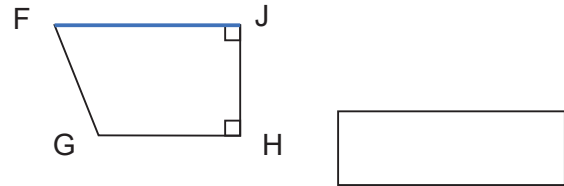
Review

1 Where is the height against each coloured base?

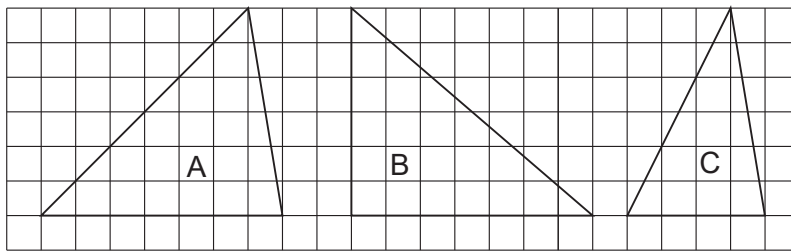
1



2

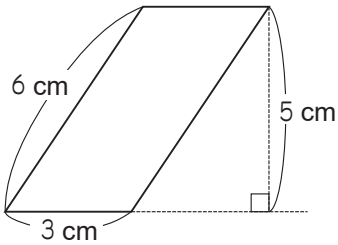


2 Which pairs of figures have the same area?



3 Find the area of the following figures.

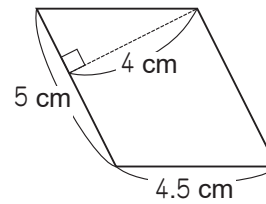
1



Math
sentence

Answer _____

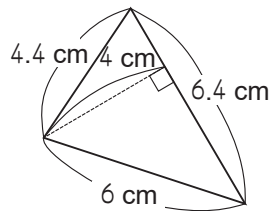
2



Math
sentence

Answer _____

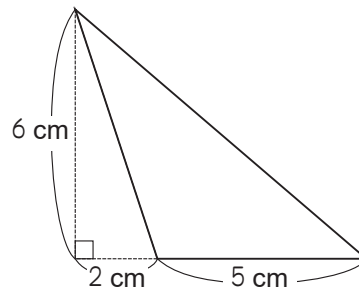
3



Math
sentence

Answer _____

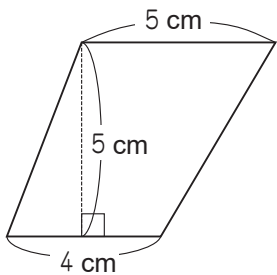
4



Math
sentence

Answer _____

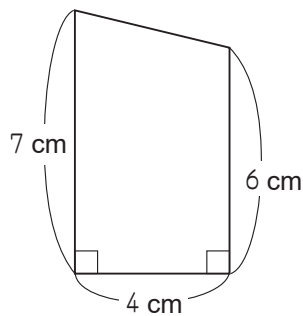
5



Math
sentence

Answer _____

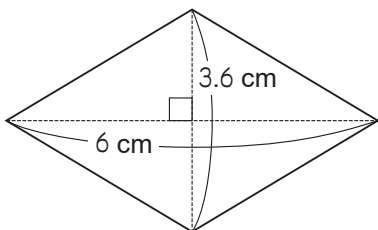
6



Math
sentence

Answer _____

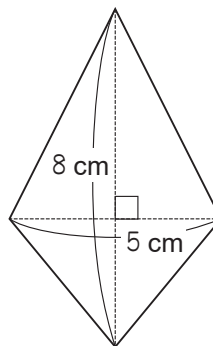
7



Math
sentence

Answer _____

8

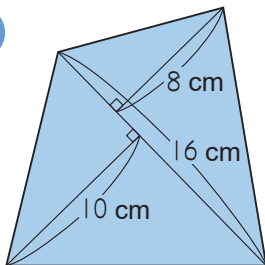


Math
sentence

Answer _____

4 Find the area of the following figures.

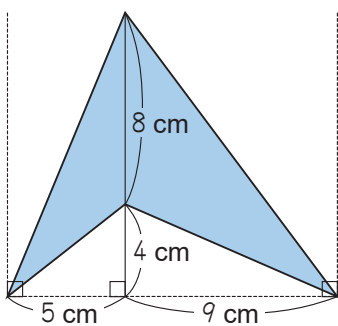
1



Math
sentence

Answer _____

2



Math
sentence

Answer _____